

CLAIMS

1. An adjustable star wheel rotatable about a central axis, comprising a pocket for receiving a container therein,  
5 and a pair of opposed, spaced apart fingers defining at least in part the pocket, each finger providing a contact surface for contacting a container when received in the pocket, wherein at least one of the fingers is rotatably mounted on a shaft extending substantially parallel to the  
10 central axis so as to be rotatable within a range of movement thereby adjusting the width of the pocket, the star wheel further comprising setting means operative to set the rotatable finger in substantially any position within the range of movement.
- 15 2. An adjustable star wheel according to Claim 1, wherein both fingers of the pair are rotatably mounted on respective shafts extending substantially parallel to the central axis so as to be rotatable in opposite senses within respective  
20 ranges of movement, and the setting means is operative to set the fingers in any position within their respective ranges of movement.
- 25 3. An adjustable star wheel according to Claim 2, wherein the shafts are circumferentially offset across the pocket.
- 30 4. An adjustable star wheel according to any preceding claim, wherein the rotatable finger is generally elongate radially with respect to the star wheel and its shaft is located at or towards an end closest to the central axis.

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5. An adjustable star wheel according to any preceding claim, further comprising a movable back plate operative to be moved substantially radially into and out from the pocket.

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6. An adjustable star wheel rotatable about a central axis comprising a plurality of pockets distributed around the star wheel, each pocket being defined at least in part by a pair of opposed, spaced apart fingers, each finger providing a contact surface for contacting a container when received in its associated pocket and being rotatably mounted on respective shafts extending substantially parallel to the central axis so as to be rotatable within a range of movement, the fingers of each pair being rotatable in opposite senses thereby adjusting the width of the pocket they define, the star wheel further comprising setting means operative to set the fingers in substantially any position within their range of movement.

20 7. An adjustable star wheel according to Claim 6, wherein neighbour fingers from adjacent pockets are mounted on their shafts in a crossed configuration.

25 8. An adjustable star wheel according to Claim 6 or Claim 7, further comprising a toothed common drive means and wherein the fingers are provided with teeth, the common drive means and fingers being arranged with meshed teeth such that the fingers are rotatably driven by the common drive means.

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9. An adjustable star wheel according to Claim 8, wherein the teeth of one finger from each pair defining a pocket

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meshes with the teeth of the drive means in a rack and pinion arrangement.

10. An adjustable star wheel according to Claim 9, wherein  
5 the teeth of the finger meshed with the common drive means  
also mesh with the teeth of its neighbour finger from the  
adjacent pocket, every other finger around the star wheel  
meshing with the common drive means such that the common  
drive means drives each set of neighbour fingers in opposite  
10 sense.

11. An adjustable star wheel according to Claim 9 or 10,  
wherein the common drive means is an annular member with a  
toothed periphery.

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12. An adjustable star wheel according to any of Claims 9  
to 11, wherein the common drive means is rotatable by manual  
adjustment.
- 20 13. An adjustable star wheel according to Claim 12, further  
comprising a thumb wheel attached to a shaft to which a cog  
wheel is also attached that engages with co-operating teeth  
of the common drive means.
- 25 14. An adjustable star wheel according to Claim 13, wherein  
the thumb wheel is attached to the shaft by an arm such that  
the thumb wheel is rotatable about the shaft on an arcuate  
path.
- 30 15. An adjustable star wheel according to Claim 14, wherein  
the thumb wheel attaches to the arm via a releasable clamp

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that clamps the thumb wheel in position, thereby providing the setting means.

16. An adjustable star wheel according to Claim 15, wherein  
5 the clamp comprises the thumb wheel and a base plate connected via a threaded post that projects through a top plate of the star wheel such that the thumb wheel may be screwed to clamp the top plate between the thumb wheel and base plate.

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17. An adjustable star wheel according to any of Claims 11 to 16, wherein the annular member has an associated travel-limiting means.

15 18. An adjustable star wheel according to Claim 17, wherein the travel-limiting means comprises a circumferentially-extending slot provided in the annular member that receives a static member therein.

20 19. An adjustable star wheel according to any preceding claim, wherein each pocket is partially defined by a second pair of fingers like the first pair, the first and second pair of fingers being spaced apart in the axial direction.

25 20. An adjustable star wheel according to Claim 19, wherein pairs of fingers separated in the axial direction are mounted on a common shaft.

30 21. An adjustable star wheel according to Claim 20, wherein the axially-separated pairs of fingers are mounted on the shaft in coupled fashion such that the fingers move in unison.

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22. An adjustable star wheel according to Claim 20, wherein the axially-separated pairs of fingers are mounted independently on the common shaft and are provided with separate drive means and separate setting means, thereby allowing independent adjustment and setting of the positions of each of the two sets of axially-separated fingers.

10 23. An adjustable star wheel according to any preceding claim, wherein the pocket is symmetrical about a centre line corresponding to the radius of the star wheel and the pair of fingers comprise curved contact surfaces whose curvature extends away from the centre line as the fingers extend away from the central axis.

15 24. An adjustable star wheel according to Claim 23, wherein the radius of curvature of the contact surfaces decreases as the fingers extend away from the central axis.

20 25. An adjustable star wheel according to any of Claims 6 to 24, further comprising a moveable back plate operative to be moved substantially radially into and out from each pocket

25 26. An adjustable star wheel according to Claim 25, wherein the back plates are moveable by a further common drive means.

30 27. An adjustable star wheel according to Claim 26, wherein the further common drive means is an annular member.

28. An adjustable star wheel according to Claim 27, wherein the back plates are mounted on substantially radially-

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extending members that overlap with the annular member, the overlapping portions being provided with a diagonally-extending slot and a post received therein such that rotation of the annular member causes radial movement of the  
5 back plates.

29. An adjustable star wheel according to Claim 27, wherein the back plates are mounted on toothed members coupled to teeth provided on a periphery of the annular member.

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30. An adjustable star wheel according to Claim 28 wherein the teeth of the members mesh with a cog wheel mounted on the shaft to which one of the fingers of each pair is mounted, the cog wheel in turn meshing with the teeth of the  
15 annular member.

31. An adjustable star wheel rotatable about a central axis comprising a disk with a periphery, the periphery being shaped to define at least in part a pocket for receiving a  
20 container therein, the star wheel further comprising a pair of opposed, spaced apart fingers positioned within the pocket, each finger providing a contact surface for contacting a container when received in the recess, wherein at least one finger is rotatable with respect to the disk  
25 about an axis substantially parallel to the central axis thereby allowing the separation of the fingers to be varied.

32. An adjustable star wheel according to claim 31, wherein both fingers of the pair are rotatable in opposite senses  
30 about an axis or axes substantially parallel to the central axis.

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33. An adjustable star wheel according to claim 32, wherein both fingers of a pair are rotatable about axes that are circumferentially offset across the recess.
- 5 34. An adjustable star wheel according to any of claims 30 to 33, wherein at least one finger is rotatable about an axis that passes through the at least one finger.
- 10 35. An adjustable star wheel according to claim 34, wherein the at least one finger is generally elongate radially with respect to star wheel and is rotatable about an axis passing through the at least one finger at or towards an end closest to the central axis.
- 15 36. An adjustable star wheel according to any of claims 30 to 35, wherein the recess is symmetrical about a centre line corresponding to the radius of the star wheel and the pair of fingers comprise curved contact surfaces whose curvature extends away from the centre line as the fingers extend away 20 from the central axis.
- 25 37. An adjustable star wheel according to claim 36, wherein the radius of curvature of the contact surfaces decreases as the fingers extend away from the central axis.
- 30 38. An adjustable star wheel according to any of claims 31 to 37, comprising a pair of rotatable fingers each provided with a plurality of teeth and wherein the pair of rotatable fingers are rotatable by a common drive means that engages with the teeth of one finger.

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39. An adjustable star wheel according to claim 38, wherein the teeth of one finger meshes with the teeth of the larger drive means in a rack and pinion arrangement.

5 40. An adjustable star wheel according to claim 39, further comprising a second recess like the first recess with a finger of the first recess being driveable directly by the drive means and wherein the second recess is located adjacent to the first recess with the teeth of a finger of  
10 the first recess meshing with the teeth of a finger of the second recess thereby making the finger of the second recess driveable indirectly by the drive means.

41. An adjustable star wheel according to claim 40,  
15 comprising a plurality of corresponding recesses forming a never-ending series around the periphery of the disk thereby enabling each finger of each recess to be paired with a finger from the adjacent recess and wherein one finger from each pair comprises teeth meshed with a larger, common drive  
20 means in a rack and pinion arrangement, the drive means being rotatable about the central axis and the other finger from each pair comprising teeth meshed with the teeth of its paired finger.

25 42. An adjustable star wheel according to claim 41, wherein the drive means is an annular member.

43. An adjustable star wheel according to claim 41 or  
claim 42, wherein the drive means is rotatable by manual  
30 adjustment.

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44. An adjustable star wheel according to any of claims 41 to 43, wherein the rack has an associated travel-limiting means.
- 5 45. An adjustable star wheel according to claim 44, wherein the travel-limiting means comprises a circumferentially-extending slot provided in the drive means that receives a member therein.
- 10 46. An adjustable star wheel according to any of claims 30 to 45, wherein at least one recess is provided with a further pair of fingers positioned within the recess, the further pair being like the first pair and spaced therefrom in the axial direction.
- 15 47. An adjustable star wheel according to claim 46, wherein the axially-spaced pairs of fingers are adjustable independently.
- 20 48. An adjustable star wheel according to claim 46 or claim 47, wherein a finger from the first pair and a finger from the further pair are mounted on a common shaft.
- 25 49. An adjustable star wheel according to any of claims 30 to 48, further comprising a second disk like the first disk, spaced therefrom in the axial direction and positioned such that the at least one recess is aligned.
- 30 50. An adjustable star wheel according to claim 49 when dependent upon claim 48, wherein the shaft serves as a spacer between the disks.

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51. An adjustable star wheel according to claim 49 or  
claim 50 when either is dependent upon claim 45, wherein the  
member serves as a spacer between the disks.

5 52. An automated handling line guide rail assembly  
comprising a guide rail defining a limit of a path of a  
container when conveyed, wherein the guide rail is connected  
to one cam such that the guide rail is moveable by rotation  
of the at least one cam at least thereby adjusting the outer  
10 limit of the path.

53. An assembly according to claim 52, wherein the guide  
rail is connected to a plurality of cams.

15 54. An assembly according to claim 53, further comprising a  
chain or a belt arranged to rotate the cams.

20 55. An assembly according to any one of claims 52 to 54,  
further comprising a pin that passes through a slot provided  
in the guide rail thereby limiting movement of the guide  
rail.

25 56. An assembly according to any of claims 52 to 55,  
further comprising a second moveable guide rail whose shape  
corresponds to that of the first guide rail and arranged to  
contact at a second point a container when conveyed, wherein  
the second guide rail is moveable independently of the first  
guide rail.

30 57. A pair of guide rail assemblies according to any of  
claims 52 to 56 arranged in a back to back alignment.

58. A star wheel conveyor comprising an adjustable star  
5 wheel according to any of claims 1 to 51 and a guide rail  
assembly according to any of claims 52 to 57.

59. A star wheel conveyor comprising an adjustable star  
wheel according to any of Claims 1 to 51 and a guide rail  
10 assembly comprising a guide rail that defines the perimeter  
of a path of a container when conveyed along part of an  
automated handling line, the path and hence the perimeter  
being arcuate about a centre and positioned at a radius from  
the centre, wherein the guide rail is movable radially to  
15 define the perimeter at a plurality of different radii from  
substantially the same centre.

60. A star wheel conveyor according to Claim 59, wherein  
the guide rail comprises at least two segments, a first  
20 segment being driveable in a substantially radial direction  
and a second segment being connected to the first segment by  
a link such that the second segment follows movement of the  
first segment.

25 61. A star wheel conveyor according to Claim 60, wherein  
the second segment is constrained to move radially by guide  
means.

30 62. A star wheel conveyor according to Claim 61, wherein the  
guide means comprises a post received within a slot, the  
slot being elongated radially.

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63. A star wheel conveyor according to Claim 61 or 62, wherein the first segment is constrained to move radially by further guide means.
- 5 64. A star wheel conveyor according to Claim 63, wherein the further guide means comprise a post received within a slot, the slot being elongated radially.
- 10 65. A star wheel conveyor according to any of Claims 59 to 64, wherein the first and second segments are arranged in superposition to overlap and are provided with a slideable link between overlapping portions to allow the separation of the first and second segments to decrease and increase as the segments move inwardly and outwardly.
- 15 66. A star wheel conveyor according to Claim 65, wherein the slideable link comprises a post received within an elongate slot.
- 20 67. A star wheel conveyor according to Claim 66, wherein the slot is elongated in a circumferential direction.
- 25 68. A star wheel conveyor according to any of Claims 60 to 67, wherein the first segment is connected to an actuator box arranged to drive the first segment radially.
69. A star wheel conveyor according to Claim 68, wherein the actuator box comprises a thumb wheel mounted on a shaft.
- 30 70. A star wheel conveyor according to Claim 69, wherein the actuator box comprises a rack and pinion, the pinion

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being provided on the shaft and the rack being aligned in the radial direction.

71. A star wheel conveyor according to any of Claims 59 to  
5 70, further comprising a clamping mechanism operable to clamp the guide rail in position.

72. A star wheel conveyor according to Claim 71 when dependent upon claim 62 or claim 64, wherein the clamping  
10 mechanism comprises a thumb wheel provided on a shaft, and the shaft corresponds to the post of the guide means or the further guide means.

73. A star wheel conveyor according to any of Claims 59 to  
15 72, further comprising a position indicator and a scale, wherein one of the position indicator or scale is fastened to the guide rail to move therewith and the other is fixed in position.

20 74. A star wheel conveyor according to any of Claim 60 to 73 further comprising a third segment wherein the third and second segments are configured to correspond to the first and second segments of any preceding claim.

25 75. A star wheel conveyor according to Claim 74, wherein the first and third segments are driven by respective actuator boxes that are coupled such that driving one actuator box drives the other actuator box.

30 76. A star wheel conveyor according to Claim 75, wherein the actuator boxes are driven by shafts coupled such that rotation of one shaft causes rotation of the other shaft.

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77. A star wheel conveyor according to Claim 76, wherein sprockets connected by a chain are mounted on the shafts.

5 78. A star wheel conveyor according to any of Claims 59 to 77, further comprising a second guide rail like the guide rail of any of claims 59 to 77.

10 79. A star wheel conveyor according to Claim 78, wherein the second guide rail is moveable independently of the first guide rail.

15 80. A star wheel conveyor according to Claim 78, wherein the second guide rail is connected to the first guide rail so that they move in unison.

20 81. A star wheel conveyor according to Claim 80 when dependent upon Claim 64, wherein the first and second guide rails are connected by the post that is received within the elongate slot of the slideable link.

25 82. A star wheel conveyor according to any of Claims 59 to 81, further comprising a second, like guide rail assembly arranged back to back with the first guide rail assembly.

83. An automated handling line comprising a rectilinear input conveyor, a star wheel conveyor according to any of Claims 59 to 82 and a rotary handling machine wherein the star wheel conveyor is arranged, in use, to receive containers travelling along the input conveyor in a recess, to convey the container in a circular path and to release

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the container on a path tangential to a rotating part of the rotary handling machine.

84. An adjustable star wheel substantially as described hereinbefore with reference to any of Figures 1 to 7 or any of Figures 13 to 23.

85. An automated handling line guide rail assembly substantially as described hereinbefore with reference to any of Figures 1 and 8 to 12.

86. An adjustable star wheel conveyor substantially as described hereinbefore with reference to any of the accompanying Figures.